6. Evaluation of Wastewater Treatment Alternatives

The wastewater treatment selection is closely related to the effluent management strategy. After initial screening of wastewater treatment plant processes, two factors arose that limited the treatment plant alternatives. First, the Hollister City Council along with other stakeholders decided that the City has a long-term goal of maximizing the use of recycled water from the treatment plant. Because of this filtration and disinfection to meet Title 22 recycled water requirements are necessary of all of the treatment plant alternatives. Second, through correspondence with the Regional Water Quality Control Board (**Appendix F**) it became clear that any effluent strategy that continued to rely on percolation would result in strict effluent limitations on nitrates. With this in mind, only processes including nitrification and denitrification were considered for further investigation. The following treatment alternatives were assessed:

- Extended Aeration System
- Oxidation Ditch
- Immersed Membrane Bioreactor (MBR)
- Sequencing Batch Reactor

Various treatment designs are possible and process selection involves consideration of many factors, including:

- wastewater effluent management
- wastewater strength
- process reliability
- operational requirements
- treatment flexibility
- available space
- solid waste disposal
- nuisance odor
- visual aesthetics
- capital and operating costs
- discharge standards
- ease or difficulty of permitting

Of the factors identified above, the method of wastewater effluent management and the restrictions imposed therein will have the greatest effect on the type of treatment required. Wastewater treatment plants in the State must be permitted by the State. WDRs and operating criteria are imposed on these plants through their permits. Depending on each plant's individual permit, design of a WWTP will be directed at meeting its specific discharge requirements and different unit processes will be assembled to achieve that goal.

This Section discusses alternative wastewater treatment conceptual design for upgrading the DWTP and summarizes the factors influencing their design and implementation. It is organized into the following subsections:

- Design Considerations
- Design Criteria
- Wastewater Treatment Alternatives
- Estimated Cost

6.1. Long-Term Wastewater Treatment Design Considerations

Design of the WWTP must balance the technical requirements of providing adequate and reliable treatment performance with more intangible factors that can affect which alternative design is selected. At a minimum, such factors include consideration of site limitations and good neighbor features that affect how the facility is perceived by the surrounding community.

6.1.1. Site Constraints

Evaluation of alternative treatment modifications and upgrades to increase the DWTP capacity must take into account inherent site constraints. Potential limitations arising from physical size, site geology, topography, and institutional issues are considered in the analysis. Based on a preliminary review of the existing site, the following potential site constraints were identified:

- limited hydraulic head due to the generally flat terrain at the DWTP,
- increased design requirements and construction efforts on new structures to offset the effects of the high groundwater level,
- limited expansion opportunities beyond the existing 50-acre treatment pond area, and
- construction limitations on work in close proximity to Highway 156.

6.1.2. Good Neighbor Factors

The DWTP is located on the outskirts of the City, but is locally situated among commercial, agricultural, and residential development. It is also adjacent to Highway 156, which experiences heavy vehicular traffic. Due to the close proximity to generally populated areas, any alternative evaluation will consider factors that could influence how the DWTP is perceived by the public during both operation and construction. In turn, this evaluation will also consider potential impacts on the health and well-being of operations staff. At a minimum, good neighbor factors will include potential issues over visual aesthetics, noise, and air quality.

Aesthetic Issues. Aesthetic issues pertaining to possible new on-site and off-site facilities will be incorporated in the alternative evaluation. In addition to the architectural appearance of structures, the aesthetic influence of exposed pipes, pumps, maintenance vehicles, and other equipment visible to passersby will also be considered. Consideration will be given to the impacts of any possible nighttime activities that could produce additional illumination to the surrounding area. Control on operational hours and/or the use of focused, directional lighting could be considered to minimize nighttime lighting disturbance.

Noise Level Concerns. Excessive noise possibly resulting from construction, routine operation, and traffic will be considered in any alternative evaluation. Identified nuisance noise will either be eliminated or mitigated to minimize public disturbance from wastewater operations and/or construction. Noise impact on operations personnel will also be considered and minimized through proper specification of equipment and sound-adsorbing enclosures or isolation. Maximum noise levels for working areas will meet California Occupational Safety and Health Administration (Cal-OSHA) requirements.

Air Quality Concerns. Wastewater treatment plants can be sources of odor, chemical emissions, particulates, and aerosols, all of which must be controlled. Air quality concerns that pose a risk to human health are addressed by the Federal Clean Air Act and locally controlled by the Regional Air Quality Control Board. Proposed alternatives will meet state and federal air quality requirements through containment and/or treatment of potentially harmful emissions releases. Aerosols and particulates from plant operations and construction will be further minimized.

Strong nuisance odors from wastewater treatment and discharge will be considered and mitigated with any alternative evaluation. The City has received odor complaints in the past, particularly when the treatment ponds turn. Consequently, alternative processes will include provisions to minimize odor concerns through the use of an odor control process, which, at a minimum, could include the following:

- Selection of low-odor solids-handling processes;
- installation of biofilters or scrubbers for foul air streams;
- dilution with odor-free gases;
- containment through the use of enclosures;
- use of masking agents; and
- chemical oxidation and precipitation of odor-causing compounds in the wastewater.

6.2. Design Criteria

Specific process goals for preliminary design of each WWTP alternative are discussed in this Section. The following is a summary of the criteria, which were based on the regulatory and environmental requirements and input from the City:

- Processes should minimize potential for odors.
- Processes should minimize noise levels during construction and during normal operation.
- Sludge dewatering/handling facilities should be utilized.
- Processes should have long solids retention time (SRT) to produce stabilized sludge suitable for on-site sludge stabilization basins (SSBs).
- Nitrogen removal is required to meet more stringent TN and/or nitrate limits.
- Algae removal may be required to reduce solids loading to the percolation beds.
- Where appropriate and practical, WWTP designs should take advantage of existing site topography and facilities.
- Plant footprints should fit within the boundaries of the existing DWTP, particularly on the space currently occupied by the primary and stabilization ponds.

6.3. Wastewater Treatment Alternatives

Four alternative wastewater treatment processes were considered for evaluation: (1) the extended aeration system, (2) an oxidation ditch, (3) immersed membrane bioreactors (MBR) and (4) sequencing batch reactors (4). These processes are representative of treatment processes capable of meeting the effluent limitations anticipated for the upgraded DWTP. Process and operational design parameters for each treatment alternative are summarized in **Table 6-1**. This Section describes the wastewater treatment processes evaluated in the LTWMP and presents preliminary design information on each alternative. Each treatment alternative was selected and developed to achieve specific goals consistent with and appropriate to the specific discharge point and scenario condition.

Table 6-1: Process and Operational Design Parameters for Treatment Alternatives

Process	Mean Cell Residence Time (MCRT) (day)	F:M (lb BOD/ lb MLVSS/day)	MLSS (mg/L)	HDT (hour)
1. Extended Aeration	20–40	0.04–0.10	2,000–5,000	20–30
2. Oxidation Ditch	15–30	0.04–0.10	3,000–5,000	15–30
3. MBR	10-30	0.05–0.40	8,000–20,000	8-20
4. SBR	10–30	0.04–0.10	2,000–5,000	15-40

6.3.1. Process Alternative 1—Extended Aeration System

Extended aeration systems are biological treatment processes that provide BOD removal and nitrification through lined aeration basins. Surface aerators or more efficient oxygen delivery systems, such as diffusers arrayed along the basin floor, can be utilize to enhance oxygen transfer efficiency (OTE).

Aeration provides an aerobic environment necessary for BOD removal and nitrification while maintaining the solids in suspension. Process design and operational parameters for the extended aeration process are shown in **Table 6-1**. Extended MCRTs allow efficient BOD removal and nitrification processes to occur.

Denitrification can be accomplished through an add-on process or by design using the aeration basin and aeration equipment, respectively. One add-on process is the construction of a separate basin upstream of the aeration basin that can support an anoxic environment where denitrifying microorganisms can synthesize soluble nitrate into nitrogen gas. Alternatively, the aeration basin can be designed to use flexible headers connected to diffusers that span the basins, perpendicular to the direction of flow. Denitrification can then be achieved simultaneously in the same basin by alternating the flow of air to the headers to provide traveling aerated and anoxic zones within the single aeration basin.

Following solids separation by the final clarifier, additional treatment may be added depending on the discharge alternative. For discharge to a recycled water system, tertiary filtration would be required as an added process prior to disinfection by sodium hypochlorite. In the case of recycled water, chlorination is preferred over UV since maintaining a chlorine residual in recycled water distribution systems is desirable.

Solids produced from WWTP operations, such as the waste activated sludge (WAS), would be routed to the SSB where the solids are concentrated, compacted, and stabilized. SSBs are designed with sufficient capacity to provide long-term stabilization of the sludge, with some facilities operating up to 10 years without requiring removal of accumulated sludge. Alternatively, the solids could be dewatered and hauled to a sludge disposal site.

The extended aeration system preliminary design incorporates several effluent management alternatives. A process train required for discharge to percolation beds, surface discharge and recycled water is shown in **Figure 6-1**.

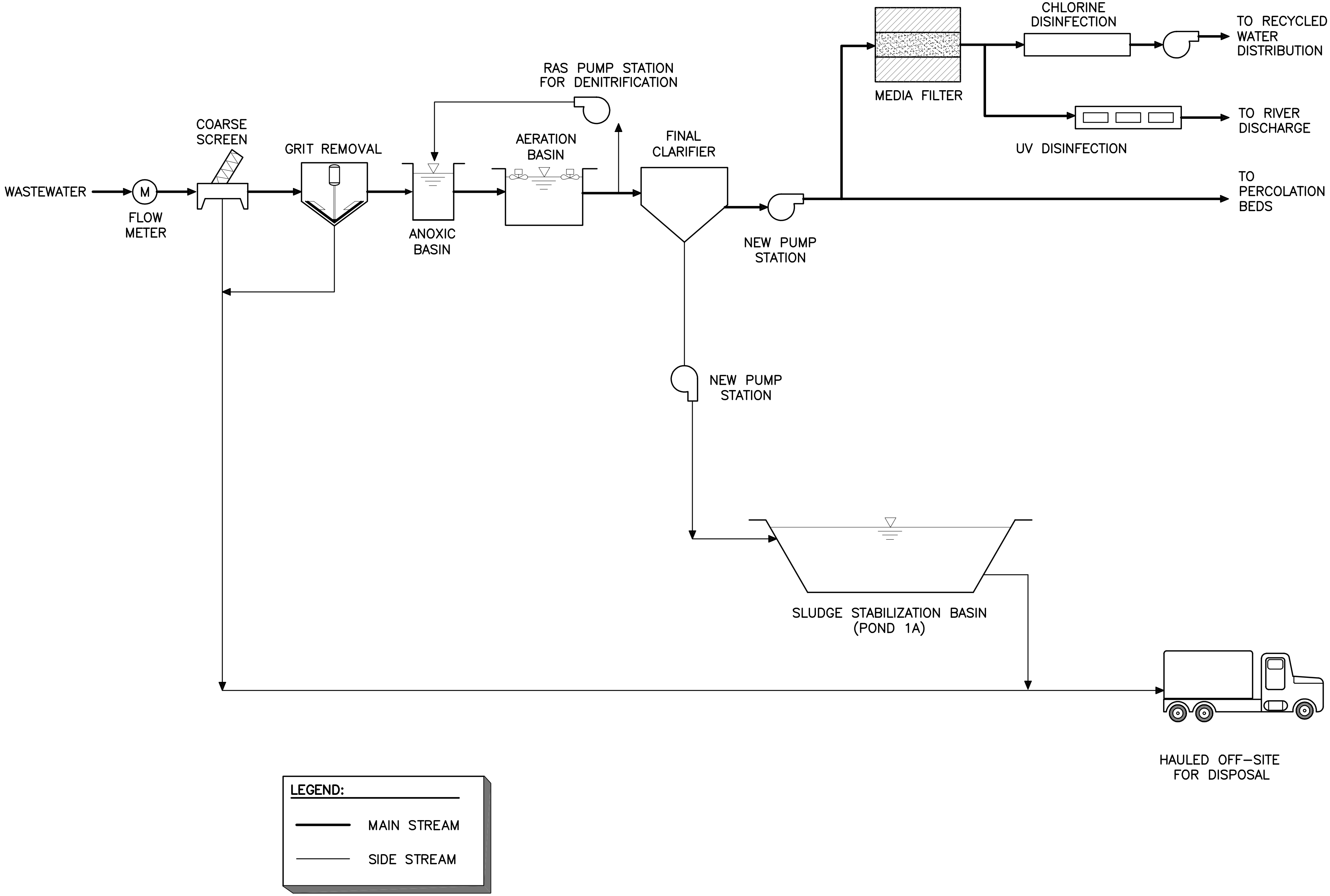

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Figure 6-1
City of Hollister Long-Term Wastewater Mangement Program
Extended Aeration System Process Flow Diagram

6.3.1.1. Facility Design

The following extended aeration facility design is based on a preliminary estimate of flows presented in **Section 4**. Facility design of the extended aeration alternative was completed on a preliminary level. A conceptual site layout is included in **Figure 6-2** showing major facility sizes and locations for treating 5.0 MGD ADF. Future additional facilities are also shown to illustrate expandability to the proposed new buildout flow of 7.5 MGD ADF. Unit process summaries for major processes are included in **Table 6-2**.

Table 6-2: Unit Process Summary for the Extended Aeration System

Unit Process [a]	Design Criteria [b]	Size (ft) [c]	Total units at ADF 5.0 MGD	Total units at ADF 7.5 MGD
Flow Meter	Range 0-28 mgd, 0.25 fps min., 33 fps max.	16 inch ∅	1	1
Screen	Inclined rotary in-channel type 0.25-inch slot width	6 ∅	1	2
Grit Chamber	Vortex type	12 ∅	1	2
Aeration Basin	20d MCRT 3,000 mg/L MLVSS	208L x 248W x 10D	2	3
Final Clarifier	< 400 gpd/ft^2/d, ADF < 800 gpd/ft^2/d, PHF < 1 lb/ft^2/hour, ADF < 1.4 lb/ft^2/hour, PHF	90∅ x 14D	2	3
UV Disinfection	Total coliform MPN 2.2 per 100 mL sample (surface discharge)	TBD	1 channel	1 channel
Tertiary Filtration	Average turbidity < 2 NTU 2.5 gpm/ft^2 at ADF with 1 cell out of service, 5.0 gpm/ft^2 at PHF	16.7L x 16.7W	6	8
Chlorination	Contact time = 120 minutes @ 5.5 mgd	435L x 8W x 9D	2	3
Sludge Stabilization Basin	15 lb MLVSS/ 1000 sq-ft/ d	38 MG	1	1

[a] Design is based on ADF.
[b] Minimum design freeboard is 2 ft.
[c] Length, width, depth, height, and diameter are denoted as L, W, D, H, and ∅ respectively. Units in ft unless noted otherwise.

Modifying the DWTP into an extended aeration system would involve extensive retrofits to most of the existing facility. This alternative would accommodate new primary, secondary, and tertiary treatment. The necessary modifications of key components are described below.

Headworks

Due to concerns related to flow measurement and odors, the Regional Board issued a Cease and Desist Order (**Appendix B**) that required a new headworks be constructed at the existing plant prior to construction of the long-term wastewater treatment facilities. The headworks upgrade was completed during the summer of 2003 as the initial construction in the phased approach and is currently in operation. To control odors and improve flow measurement, a new influent lift station was constructed. It was equipped with a mechanical grinder, an odor control biofilter, and a magnetic flow meter. Flow measurement is accomplished by a magnetic flow meter installed in a section of pipe that is always submerged. The headworks improvements can be integrated into any new design alternative.

Influent Pump Station

In order to minimize excavation required at the location selected for the extended aeration basins, the influent pump station (incorporated in the new headworks) would be required to lift the wastewater to the

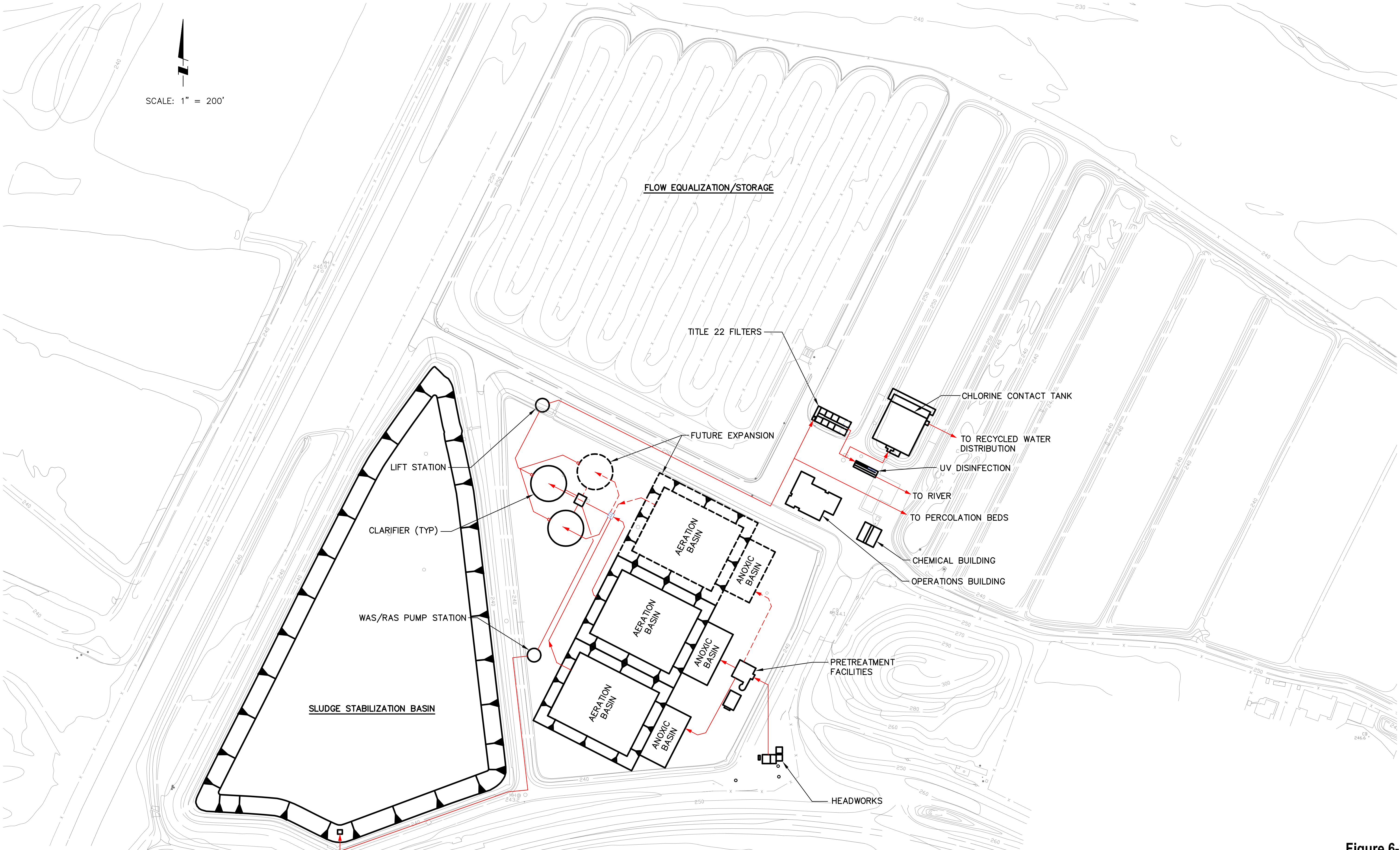

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Figure 6-2
City of Hollister Long-Term Wastewater Management Program
Extended Aeration System Conceptual Site Layout

high water level in the pretreatment facilities. Once pumped to this elevation, the remainder of the flow through the biological processes would be by gravity. The influent pump station has a high level overflow that diverts wastewater to an equalization basin (Pond 1B) in the event the pump station fails or cannot match the influent flow. The pump station is designed to handle the design peak hour flow. Space has been provided for addition of future pumps for expansion to the future buildout peak hour flow.

Pretreatment

The pretreatment facilities consist of screening, grit removal and flow distribution. All wastewater flows into a common rectangular channel at the beginning of the pretreatment facility. A flow-splitting structure allows the flow to be split to two identical channels. One channel houses a self-cleaning fine screen. The second channel is a bypass channel and contains a manual bar screen. Under normal operation, all wastewater flows through the self-cleaning coarse screen. However, a weir allows wastewater to either overflow or be diverted to the bypass channel, in the event the self-cleaning screen fails or is down for maintenance.

The self-cleaning screen is an inclined in-channel rotary screen. This type of screen utilizes a slotted or perforated cylinder as the screen. The cylinder is mounted in the rectangular channel at a 45-degree angle and a helical screw/scraper conveys solids up the cylinder into a dewatering section and then into a holding bin. The advantage of using this type of screen is that the screening, washing and compacting of the screened material is accomplished in one unit. Another advantage is that the top portion of the screen (above the channel) can be enclosed for odor control, as well as the solids discharge shaft to the screenings bin.

Following screening, the channel allows future addition of grit removal. Grit removal would not necessarily be required for the extended aeration alternative. If selected, a vortex type grit chamber would be designed to separate the grit from the screened wastewater. The grit would be pumped to a grit classifier to remove organics from the inert grit and to dewater the grit. The grit classifier and grit bin would be housed in a building to contain odors and minimize vector attraction.

All pretreatment channels, screening and grit facilities are enclosed to contain foul odors. A blower and a biofilter scrub foul air for odor removal. The blower continuously pulls air from the headspace in the enclosed facility. This maintains a negative pressure in the structure so that air cannot escape from the facility. The blower discharges into an odor control biofilter. The biofilter can be a compost design or a packaged synthetic media design.

Extended Aeration System

The extended aeration system would consist of a square concrete basin with a series of aeration headers and diffuser assemblies. The extended aeration basins could be designed with vertical or sloped sidewalls. Two separate extended aeration process trains would be provided for flexibility for O&M of the system over a wide range of flows. The existing primary Pond 1B would be converted to accommodate the basins. Each basin would be approximately 208 ft wide by 248 ft long by 10 ft side water depth and have a volume of approximately 3.0 MG each. Space would be designated for addition of a third extended aeration system in the future to meet future buildout flows.

The system would contain an anoxic zone upstream of an aerated zone. Raw wastewater would be blended with a recycled stream of oxidized/nitrified effluent from the aeration zone and then introduced to the anoxic zone, where anoxic bacteria will accomplish denitrification. The raw wastewater blend is required to provide a source of carbon for the biological denitrification process. From the anoxic zone, the effluent would flow by gravity to the aeration zone. The aeration zone would contain an aeration system sized to accomplish both BOD removal and nitrification. It may be possible to use the existing surface aerators, though more efficient aeration systems may provide improved performance and lower operating costs.

Alternatively, denitrification could be achieved in the same basin by alternating aerated and anoxic zones, if certain proprietary aeration systems are utilized. In such a system, only one basin would be required, though the total basin volume required would be similar to the two-basin system described above.

A portion of the activated sludge that settles in the clarifiers would be returned to the extended aeration system to maintain the required mixed liquor concentration. Excess sludge would be wasted to the sludge stabilization basin. Typical SRTs in the extended aeration system are 20 days or greater. This results in a partially digested and stabilized biomass.

From the basins, the two process streams would be combined and advance to a flow-splitting structure upstream of the clarifiers. The wastewater would flow by gravity through the extended aeration system to the secondary clarifiers.

Clarifiers

Two circular clarifiers would be provided for secondary sedimentation. A flow-splitting structure upstream of the clarifiers would ensure even distribution of flow to the two clarifiers. Each clarifier would have a working diameter of approximately 90 ft and a working depth of 14 ft. A surface skimmer would remove floating material, while scrapers at the bottom would collect sludge for return to the extended aeration system or the SSB. From the clarifiers, water would flow to a wet well to pump water to Title 22 filters for river discharge or recycled water production. Space would be designated for addition of a third clarifier in the future to meet future buildout flows. Clarified effluent may be sent directly to percolation beds or first through the filters prior to percolation.

Sludge Stabilization Basin

Existing Primary Pond 1A would be converted into a sludge stabilization basin (SSB). WAS would be collected from the secondary clarifiers for further stabilization in the SSB. The SSBs would have enough capacity to provide long-term storage. Based on the size of the existing Pond 1A, it is expected that the sludge storage capacity would exceed 10 years.

Solids Dewatering

As an option waste sludge from the clarifiers could be mechanically dewatered. The dewatered sludge would be taken to a landfill for disposal. Note that this sludge would not meet Class B requirements and could not be eligible for beneficial reuse without further treatment. At a minimum a facility including a sludge storage tank, sludge feed pump, polymer feed system and a two-meter belt filter press would be required for the initial construction. Provisions for adding a second belt press would be made. The belt press and ancillary equipment would be housed in building to protect the equipment from weather and to contain any odors. Dewatered sludge from the belt filter press would be conveyed via a screw conveyor to a waste container or truck trailer.

Flow Equalization and Storage

Ponds 2, 3A, and 3B would be converted to storage for flow equalization and/or storage of treated effluent. Accumulated sludge in these ponds will be removed. New inlet and outlet structures would be constructed to allow movement of screened influent or recycled water in to and out of these ponds.

UV Disinfection

For effluent to be discharged to a surface water, UV disinfection is proposed to eliminate the need for dechlorination and to eliminate the potential for chlorine residual discharge violations. It is expected that a maximum total coliform MPN of 2.2 per 100 mL will be required. Space would be provided in the channel for addition of future banks for expansion to future buildout flows. Validation testing for Title 22 certification would not be required. It is anticipated that no disinfection limits would be required on effluent discharged to the percolation beds. Therefore, this effluent stream could bypass the UV channel or chlorination system and be applied to the percolation beds as undisinfected secondary or undisinfected tertiary effluent.

Title 22 Media Filter

Media filtration would follow the clarifiers for additional effluent polishing and for the production of recycled water. Media filtration would be required to meet the Title 22 *Water Recycling Criteria*. The *Water Recycling Criteria* includes minimum design requirements, certifications, and turbidity requirements. It is expected that recycled water would only be required during the dry season. Thus, the Title 22 filtration facilities would be sized based on the design ADF. Space would be designated for addition of future filtration facilities to meet the future buildout ADF.

Two types of single media sand filters have proven most effective for Title 22 applications. One type utilizes a sand filter with a continuous backwash mechanism. Continuous backwash rates are set by adjusting weir levels within the filter. Another system utilizes a conventional downflow sand filter with intermittent backwash cycles. In this system, backwash cycles are controlled by an increase in water depth above the filter or an increase in headloss through the filter.

A third filter alternative is the use of a cloth media filter. This filter utilizes a cloth media mounted on a disk as the filtration barrier to remove solids. Flows directions can either be outside-in or inside-out on these types of filters. The cloth media filters are equipped with a backwash system to clean the filter media when it becomes clogged with solids.

Any filtration systems require the addition of flocculants, such as alum and/or polymers. Each type of filtration system would be adequate for this process train.

Chlorine Disinfection

Chlorine disinfection is preferred for water recycling applications in order to provide a residual in the recycled water distribution system. Thus, a chlorine disinfection system would be provided for the Title 22 recycled water sidestream. Effluent from the Title 22 filters would flow to the chlorine disinfection system. The proposed disinfection system would use sodium hypochlorite as the disinfectant. Disinfection would be accomplished in a chlorine contact basin sized to meet Title 22 *Water Recycling Criteria*. The criteria require that the basin provide a minimum modal contact time of 90 minutes and a minimum CT of 450 mg-minutes/L. Thus, for a modal contact time of 90 minutes, the minimum chlorine residual in the chlorine contact basin would be 5 mg/L. The chlorine contact tank would be designed for an HRT of 120 minutes at MDF (5.5 mgd) to ensure a modal contact time of 90. The basin would consist of a multi-pass structure with a minimum length to width ration of 40:1 to promote plug flow. Inlet/outlet structures and knockout walls would be provided to allow additional passes to be constructed to meet future buildout flows.

Recycled Water Pump Station

A recycled water pump station would be required for recycled water distribution. The size and type of pumps required would be determined based on the hydraulic flow and storage characteristics and requirements of the recycled water distribution system.

Chemical Storage and Handling Facilities

The chlorine disinfection system would require sodium hypochlorite, which would be stored in a 8,000-gallon polyethylene tank. Duty and standby metering pumps would be provided for supply of sodium hypochlorite to the chlorine contact tank. It is expected that the metering pumps would be located indoors within an area for designed for spill containment. The chemical storage would be located outdoors in another spill containment structure. A canopy would be provided to shade the storage tank.

6.3.1.2. Non-economic Advantages/Disadvantages

The non-economic advantages and disadvantages of the extended aeration system are summarized in **Table 6-3**.

Table 6-3: Non-economic Advantages and Disadvantages of the Extended Aeration System

Advantages	Disadvantages
Easier to operate than some conventional sludge systems.	Larger footprint compared to conventional activated sludge systems.
Lower waste sludge production than conventional activated sludge plants.	Vulnerable to future regulatory change.
Achieves nitrogen removal.	Add-on process for nitrogen removal may be required to ensure reliable treatment performance.
Minimal chemical storage/handling.	Most extended aeration systems produce lower quality effluent than conventional treatment systems.
	Vulnerable to bulking sludge.

6.3.2. Process Alternative 2—Oxidation Ditch

The oxidation ditch is based on a conventional activated sludge process modified for nitrogen removal and augmented with a tertiary treatment process. An oxidation ditch is a variation of the activated sludge process that reliably produces a high quality effluent. The design is well established, relatively easy to operate, and produces effluent with low SS, TN, and BOD.

Compared to the extended aeration system, the oxidation ditch is more mechanically intensive, requiring additional pumps and controls to moderate process dynamics for the use of return activated sludge (RAS) and WAS, respectively. Discharge alternatives for consideration include the percolation bed, water recycling, and river discharge.

Oxidation ditches are biological treatment processes that achieve BOD removal and combined nitrification and denitrification through a plug-flow reactor design, as opposed to the previous complete-mix-type basins. This difference in the process reactor takes advantage of a different aeration method, which in turn changes the biochemical kinetics but still achieves the same treatment objectives. In an oxidation ditch, the wastewater is aerated with brush, disk, or surface aerators that introduce the oxygen required for microorganisms to metabolize the BOD. At the same time, these aerators impart a velocity to the water that causes it to recirculate around the oxidation ditch, which is designed around a racetrack configuration. As the wastewater is brushed along a racetrack, oxygen is transferred producing an aerobic zone where BOD removal and nitrification occur. As the wastewater continues down the racetrack, oxygen becomes depleted leaving an anoxic zone where denitrification occurs.

As microorganisms in the oxidation ditch metabolize BOD, biomass is produced and later settled. Downstream of the oxidation ditch, the final clarifier separates the biomass through gravitational settling. Since the settled solids are rich in biomass, a portion of the settled sludge is either returned to the oxidation ditch (RAS) to maintain an adequate population of microorganisms or removed from the process entirely for disposal (WAS).

Clarified effluent continues down the process train undergoing additional treatment depending on the discharge capacity and/or discharge point. If the discharge point is surface-discharge to the river, then the clarified effluent must first be filtered to meet possible turbidity limits on the river and then disinfected with UV light. UV disinfection is preferred for river discharge since it avoids chemical addition, such as with chlorination, which increases the risk of DBP formation. Disinfection by UV would allow the facility to consistently and reliably meet the stringent coliform limits for a surface discharge. For discharge to a recycled water system, tertiary filtration would be required as an added process prior to disinfection by sodium hypochlorite.

Waste sludge and solids residuals would be disposed of in one of the existing facultative treatment ponds, which would be converted to an SSB. At the SSB, the solids residuals are concentrated, compacted, and further stabilized. SSBs are designed with sufficient capacity to provide long-term stabilization of the sludge, with some facilities operating up to 10 years without requiring removal of accumulated sludge. Alternatively, the solids could be dewatered and hauled to a sludge disposal site.

The extended aeration system preliminary design incorporates several effluent management alternatives. A process train required for discharge to percolation beds, surface discharge and recycled water only is shown in **Figure 6-3**.

6.3.2.1. Facility Design

The following oxidation ditch facility design is based on a preliminary estimate of flows presented in **Section 4**. Facility design of the oxidation ditch alternative was completed on a preliminary level. A conceptual site layout is included in **Figure 6-4** showing major facility sizes and location for treating 5.0 MGD ADF. Both alternatives (with and without water recycling) are summarized in this figure. Future additional facilities are also shown to illustrate expandability to the proposed new buildout flow of 7.5 MGD ADF. Unit process summaries for major processes are included in **Table 6-4**.

Table 6-4: Unit Process Summary for the Oxidation Ditch

Unit Process [a]	Design Criteria [b]	Size (ft) [c]	Total units at ADF 5.0 MGD	Total units at ADF 7.5 MGD
Flow Meter	Range 0-28 mgd, 0.25 fps min., 33 fps max.	16 inch ∅	1	1
Screen	Inclined rotary in-channel type 0.25-inch slot width	6 ∅	1	2
Grit Chamber	Vortex type	12 ∅	1	2
Oxidation Ditch	20d MCRT 3,000 mg/L MLVSS	200L x 80W x 14D	2	3
Final Clarifier	< 400 gpd/ft^2/d, ADF < 800 gpd/ft^2/d, PHF < 1 lb/ft^2/hour, ADF < 1.4 lb/ft^2/hour, PHF	90 ∅ x 14D	2	3
UV Disinfection	MPN 2.2 per sample (surface discharge)	TBD	1 channel	1 channel
Tertiary Filtration	Average turbidity < 2 NTU 2.5 gpm/ft^2 at ADF with 1 cell out of service, 5.0 gpm/ft^2 at PHF	16.7L x 16.7W	6	8
Chlorination	Contact time = 120 minutes @ 5.5 mgd	435L x 8W x 9D	2	3
Sludge Stabilization Basin	15 lb MLVSS/ 1000 sq-ft/ d	38 MG	1	1

[a] Design is based on ADF.
[b] Minimum design freeboard is 2 ft.
[c] Length, width, depth, height, and diameter are denoted as L, W, D, H, and ∅ respectively.

Modifying the DWTP into an oxidation ditch system involves extensive retrofits. The oxidation ditch system would include a new process for primary, secondary, and tertiary treatment. The necessary modifications of key components are described below.

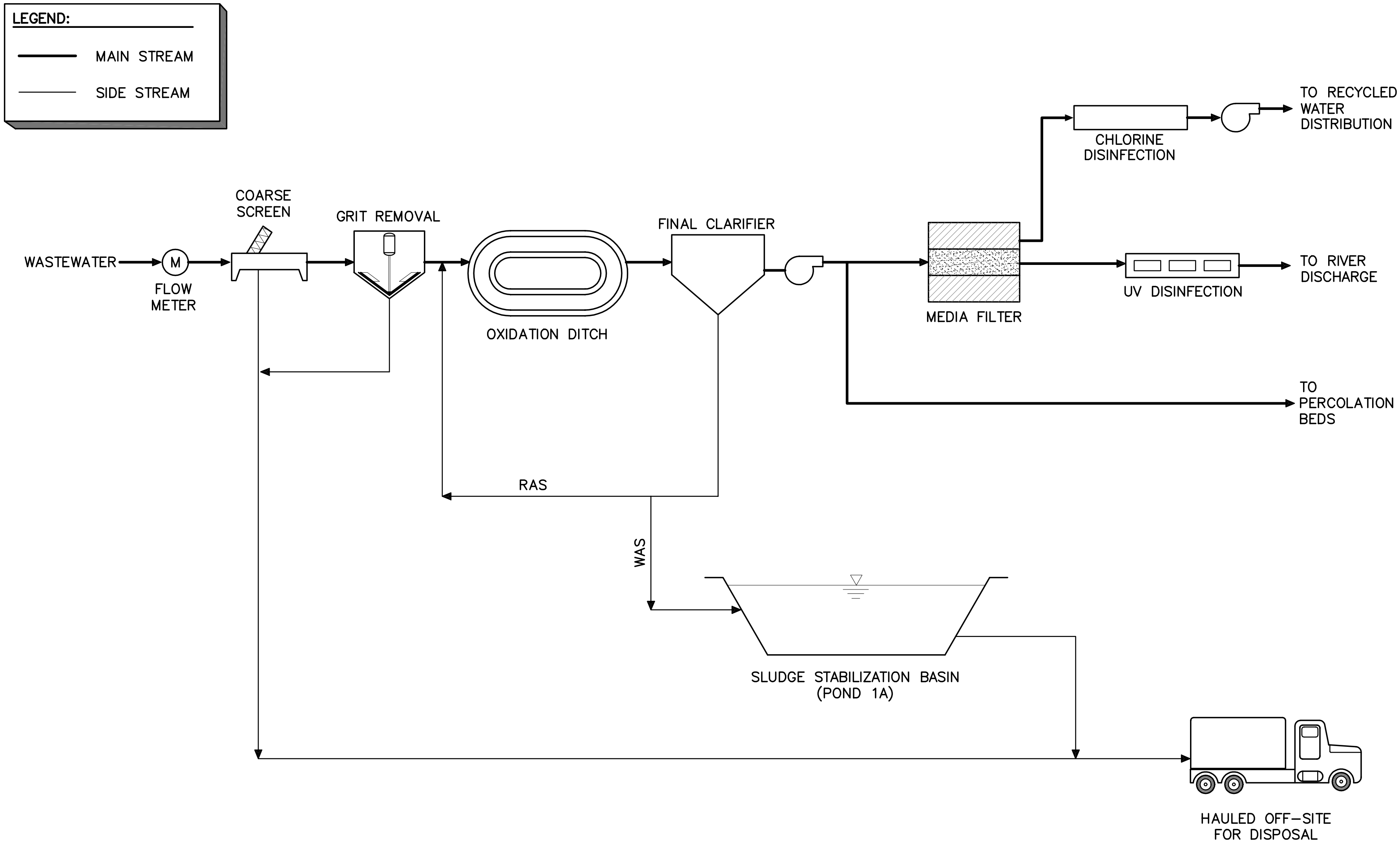

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Figure 6-3
City of Hollister Long-Term Wastewater Management Program
Oxidation Ditch Process Flow Diagram with Reclamation

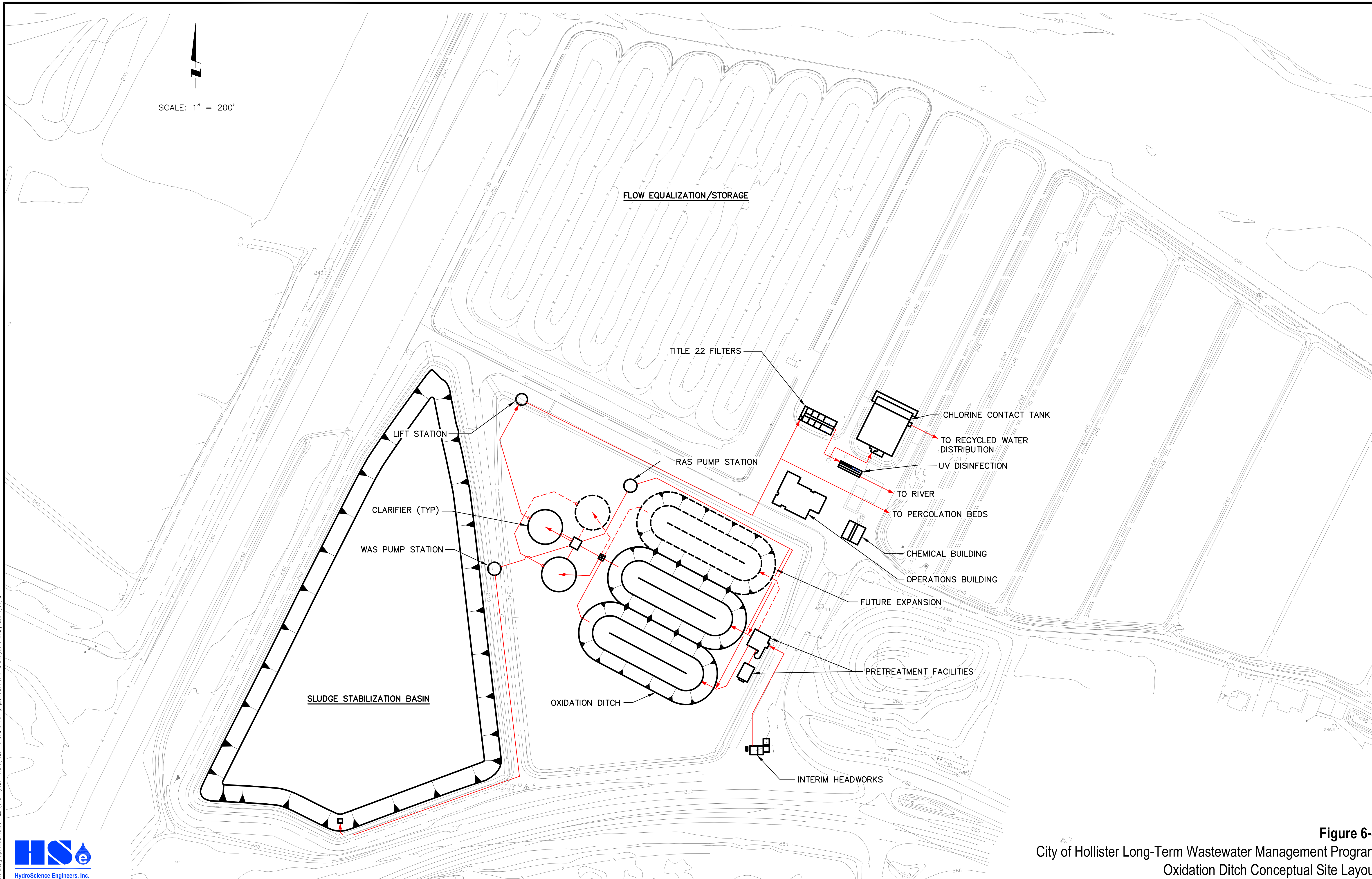

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Figure 6-4

City of Hollister Long-Term Wastewater Management Program

Oxidation Ditch Conceptual Site Layout

Headworks

The existing headworks would be incorporated into the oxidation ditch design as detailed previously in **Section 6.3.1.1**.

Influent Pump Station

In order to minimize excavation required at the location selected for the oxidation ditch basins, the influent pump station (incorporated in the existing headworks) would be required to lift the wastewater to the high water level in the pretreatment facilities. Once pumped to this elevation, the remainder of the flow through the biological processes would be by gravity. The influent pump station has a high level overflow that diverts wastewater to an equalization basin (Pond 1B) in the event the pump station fails or cannot match the influent flow. The pump station is designed to handle the design peak hour flow. Space has been provided for addition of future pumps for expansion to the future buildout peak hour flow.

Pretreatment

The pretreatment facilities consist of screening, grit removal and flow distribution. All wastewater flows into a common rectangular channel at the beginning of the pretreatment facility. A flow-splitting structure allows the flow to be split to two identical channels. One channel houses a self-cleaning fine screen. The second channel is a bypass channel and contains a manual bar screen. Under normal operation, all wastewater flows through the self-cleaning coarse screen. However, a weir allows wastewater to either overflow or be diverted to the bypass channel, in the event the self-cleaning screen fails or is down for maintenance.

The self-cleaning screen is an inclined in-channel rotary screen. This type of screen utilizes a slotted or perforated cylinder as the screen. The cylinder is mounted in the rectangular channel at a 45-degree angle and a helical screw/scraper conveys solids up the cylinder into a dewatering section and then into a holding bin. The advantage of using this type of screen is that the screening, washing and compacting of the screened material is accomplished in one unit. Another advantage is that the top portion of the screen (above the channel) can be enclosed for odor control, as well as the solids discharge shaft to the screenings bin.

Following screening, the channel allows future addition of grit removal. Grit removal would not necessarily be required for the oxidation ditch alternative. If selected, a vortex type grit chamber would be designed to separate the grit from the screened wastewater. The grit would be pumped to a grit classifier to remove organics from the inert grit and to dewater the grit. The grit classifier and grit bin would be housed in a building to contain odors and minimize vector attraction.

All pretreatment channels, screening and grit facilities are enclosed to contain foul odors. A blower and a biofilter scrub foul air for odor removal. The blower continuously pulls air from the headspace in the enclosed facility. This maintains a negative pressure in the structure so that air cannot escape from the facility. The blower discharges into an odor control biofilter. The biofilter can be a compost design or a packaged synthetic media design.

Oxidation Ditch

The secondary treatment equipment would be installed on the site of the primary treatment pond 1B. That area is at a lower elevation than the headworks, therefore the wastewater would flow by gravity to the oxidation ditch.

The oxidation ditch system would provide a racetrack configuration containing aeration and anoxic zones. The oxidation ditch would be approximately 200 ft long by 80 ft wide by 14 ft deep and have a volume of approximately 3.2 MG. Two separate oxidation ditch process trains would be provided for flexibility for operation and maintenance (O&M) of the system over a wide range of flows. The existing primary pond

1B would be converted to accommodate this system. A portion of the activated sludge that settles in the clarifiers would be continuously returned to the oxidation ditch to maintain the required mixed liquor concentration. Excess sludge would be wasted to the SSB.

From the oxidation ditches, the two process streams would be combined and advance to a flow-splitting structure upstream of the clarifiers. The wastewater would flow by gravity through the oxidation ditch and to the secondary clarifiers.

Clarifiers

Two circular clarifiers would be provided for secondary sedimentation. A flow-splitting structure upstream of the clarifiers would ensure even distribution of flow to the two clarifiers. Each clarifier would have a working diameter of approximately 90 ft and a working depth of 14 ft. A surface skimmer would remove floating material, while scrapers at the bottom would collect sludge for return to the extended aeration system or the SSB. From the clarifiers, water would flow to a wet well to pump water to Title 22 filters for river discharge or recycled water production. Space would be designated for addition of a third clarifier in the future to meet future buildout flows. Clarified effluent may be sent directly to percolation beds or first through the filters prior to percolation.

Sludge Stabilization Basin

Existing Primary Pond 1A would be converted into an SSB. WAS would be collected from the secondary clarifiers for further stabilization. The storage basins would have enough capacity to provide long-term storage. Based on the size of the existing Pond 1A, it is expected that the sludge storage capacity would exceed 10 years.

Solids Dewatering

As an option waste sludge from the clarifiers could be mechanically dewatered. The dewatered sludge would be taken to a landfill for disposal. Note that this sludge would not meet Class B requirements and could not be eligible for beneficial reuse without further treatment. At a minimum a facility including a sludge storage tank, sludge feed pump, polymer feed system and a two-meter belt filter press would be required for the initial construction. Provisions for adding a second belt press would be made. The belt press and ancillary equipment would be housed in building to protect the equipment from weather and to contain any odors. Dewatered sludge from the belt filter press would be conveyed via a screw conveyor to a waste container or truck trailer.

Flow Equalization and Storage

Ponds 2, 3A, and 3B would be converted to storage for flow equalization and/or storage of treated effluent.

Title 22 Media Filtration

The design of the media filters would utilize the same approach detailed previously in **Section 6.3.1.1**. However, it is expected that media filtration would be sized for both surface water discharge and recycled water production.

UV Disinfection

For surface water discharge, it is assumed that the disinfection standard will be a total coliform MPN of 2.2 per 100 mL. The type and design of the UV disinfection system would be as described previously in **Section 6.3.1.1**. Effluent from the Title 22 sand filters earmarked for surface water discharge would flow to the UV system dedicated to surface water discharge.

Chlorine Disinfection

As described previously, chlorine disinfection is preferred for water recycling applications. A chlorine disinfection system would be provided for the Title 22 recycled water sidestream. Effluent from the Title 22 sand filters would flow to the chlorine disinfection system. The design of the chlorine disinfection system would be as described in **Section 6.3.1.1** for Alternative 1.

Recycled Water Pump Station

A recycled water pump station would be required for recycled water distribution. The size and type of pumps required would be determined based on the hydraulic flow and storage characteristics and requirements of the recycled water distribution system.

Chemical Storage and Handling Facilities

The chlorine disinfection system would require sodium hypochlorite, which would be stored in an 8,000-gallon polyethylene tank. Duty and standby metering pumps would be provided for supply of sodium hypochlorite to the chlorine contact tank. It is expected that the metering pumps would be located indoors within an area for designed for spill containment. The chemical storage would be located outdoors in another spill containment structure. A canopy would be provided to shade the storage tank.

6.3.2.2. Non-economic Advantages/Disadvantages

The non-economic advantages and disadvantages of the oxidation ditch system are summarized in **Table 6-5**.

Table 6-5: Non-economic Advantages and Disadvantages of the Oxidation Ditch

Advantages	Disadvantages
Smaller footprint.	Clarification stability susceptible to activated sludge process upsets.
High effluent quality.	Dedicated sludge handling facilities required.
Achieves nitrogen removal.	
Nonproprietary design allows competitive bidding.	

6.3.3. Process Alternative 3—Immersed Membrane Bioreactor

MBRs are state-of-the-art treatment processes designed to treat wastewater using the same principles as conventional activated sludge processes. That common driving principle is the conversion of soluble waste into biomass. The difference is the rate at which these reactions are occurring and also the method by which the separation of solids occurs. Compared to conventional activated sludge, which relies on a clarifier for gravitational separation of solids, MBRs utilize membrane technology to physically separate the solids. The result is a more uniform effluent quality and enhanced biological treatment performance because of the higher microorganism concentrations not previously possible with activated sludge.

Using membrane technology, high-quality effluent is produced that can be readily applied to a variety of discharge reuse alternatives. Discharge alternatives for consideration using this process include the percolation bed, recycled water, and river discharge.

MBRs consolidate many of the unit processes required in a conventional activated sludge design. Fine screening is required to protect the immersed membranes. In addition, if grit is found to be present in the wastewater, grit removal may be necessary. However, the process combines oxidation, clarification, and filtration into one step. A bioreactor with separate anoxic and aerobic cells provides the environment necessary for BOD removal, nitrification, and denitrification processes to occur. As a result of the high concentrations of microorganisms that synthesize the waste, uptake rates are significantly increased.

Membrane modules immersed in the aerobic portion of the process tank combine the functions of the clarifier and tertiary filtration processes in a single step. The membranes are typically classified as microfiltration or ultrafiltration and have nominal pores with a diameter of 0.1 to 0.4 μm. Filtration by this method produces an effluent with very low solids concentration. After filtration, the membrane effluent, called permeate, is ready for disinfection.

Depending on the discharge point, the permeate is disinfected with either UV or sodium hypochlorite. For discharge to the river, UV is well-suited since a very low solids concentration minimizes shielding of bacteria. As a result, UV disinfection provides efficient and consistent microbial inactivation without increased risk of chemical DBP formation. In the case of discharge for recycled water, chlorination is preferred over UV since maintaining a chlorine residual in recycled water distribution systems is desirable.

Waste sludge and solids residuals would be disposed of in one of the existing facultative treatment ponds, which would be converted to an SSB. At the SSB, the solids residuals are concentrated, compacted, and further stabilized. SSBs are designed with sufficient capacity to provide long-term stabilization of the sludge, with some facilities operating in excess of 10 years without requiring removal of accumulated sludge. Alternatively, the solids could be dewatered and hauled to a sludge disposal site.

The MBR system preliminary design incorporates several effluent management alternatives. A process train required for discharge to percolation beds, surface discharge and recycled water is shown in **Figure 6-5**.

6.3.3.1. Facility Design

The following MBR facility design is based on a preliminary estimate of flows presented in **Section 4**. Facility design of the MBR alternative was completed on a preliminary level. A conceptual site layout is included in **Figure 6-6** showing major facility sizes and locations for treating 5.0 MGD ADF. Future additional facilities are also shown to illustrate expandability to the proposed new buildout flow of 7.5 MGD ADF. Unit process summaries for major processes are included in **Table 6-6**.

Table 6-6: Unit Process Summary for the Immersed Membrane Bioreactor

Unit Process [a]	Design Criteria [b]	Size (ft) [c]	Total units at ADF	
			5.0 MGD	7.5 MGD
Flow meter	Range 0-28 mgd, 0.25 fps min., 33 fps max.	16 inch ∅	1	1
Fine screen	Rotary drum screen 1-3 mm perforations	20L x 2.5W	1	2
Grit removal	Vortex type	12 ∅	1	2
Anoxic basin	4 hour HDT	43L x 30W x 22D	4	6
Aeration basin	10 hour HDT	110L x 30W x 21D	4	6
Immersed membrane bioreactor	10.4 gfd @ ADF; 18.1 gfd @ PHF 3.6 hour HDT 6:1 recycle ratio	63L x 10W x 9D	4	5
UV disinfection	Total coliform MPN 2.2 per 100 mL sample (surface discharge)	TBD	1 channel	1 channel
Chlorination	Contact time = 120 minutes @ 5.5 mgd	660L x 10W x 10D	2	3
Sludge stabilization basin	15 lb MLVSS/ 1000 sq-ft/ d	38 MG	1	1

[a] Design is based on ADF.
[b] Minimum design freeboard is 2 ft.
[c] Length, width, depth, height, and diameter are denoted as L, W, D, H, and ∅ respectively.

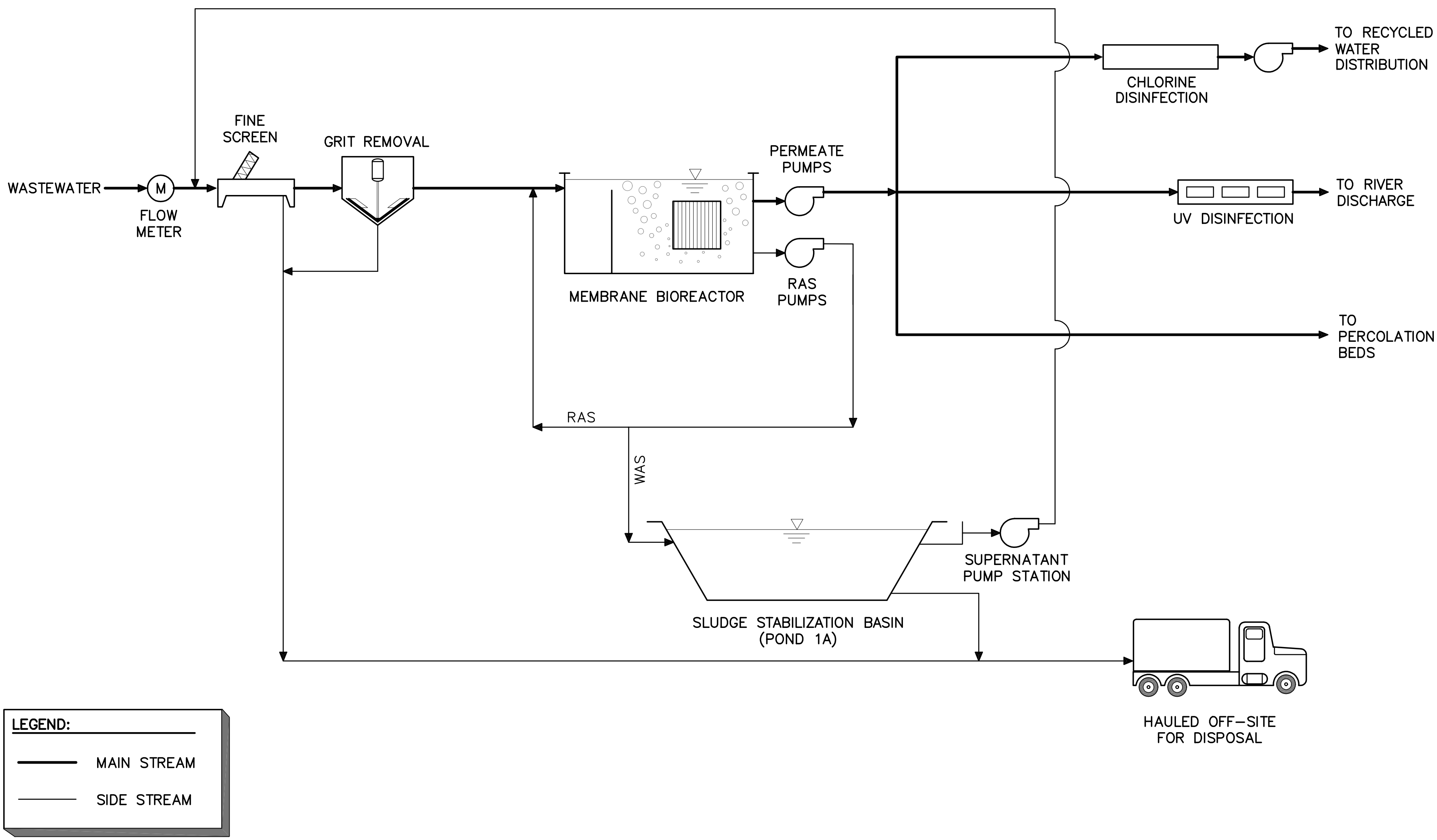

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Figure 6-5
City of Hollister Long-Term Wastewater Management Program
Immersed Membrane Bioreactor Process Flow Diagram with Reclamation

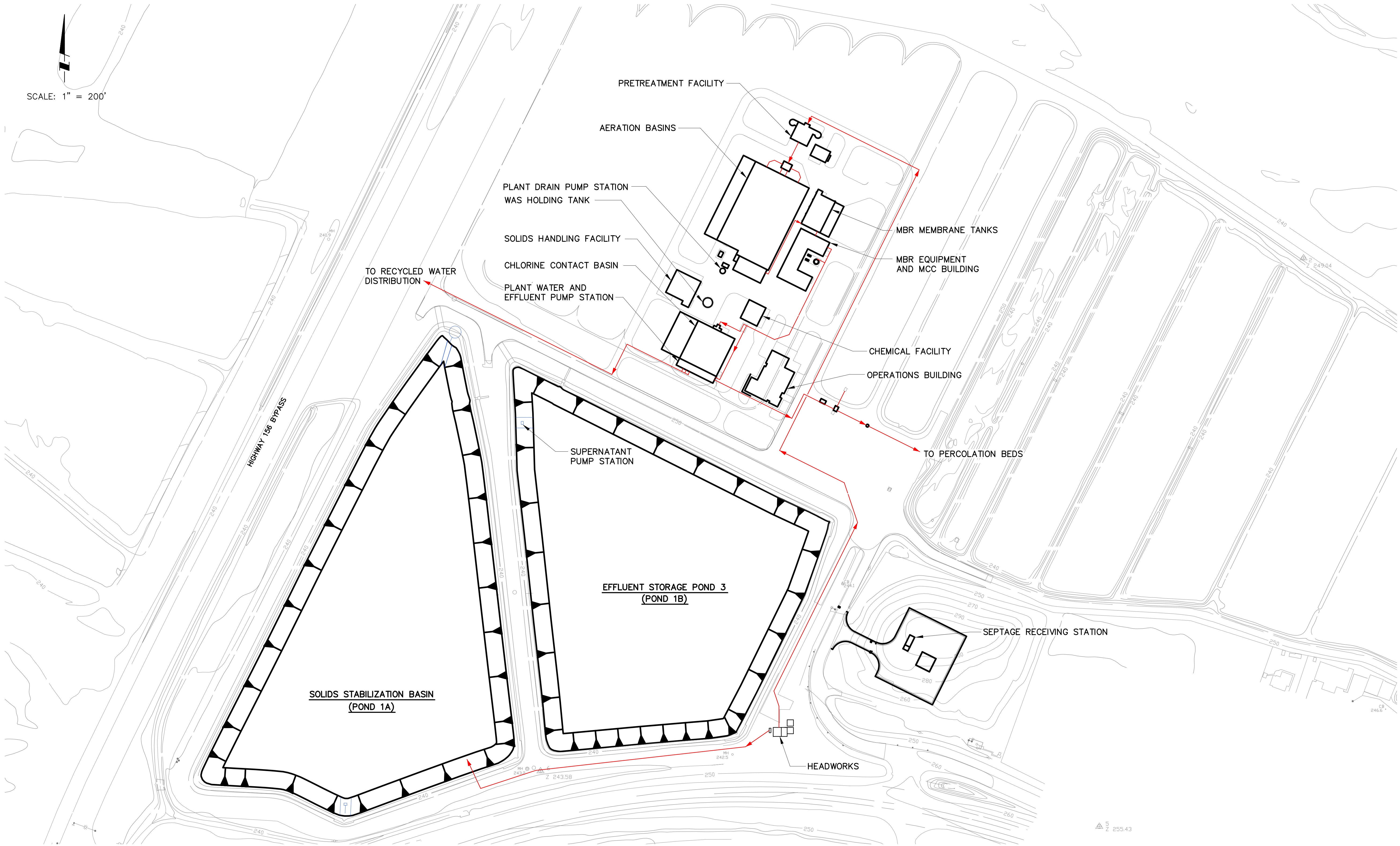

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Figure 6-6

City of Hollister Long-Term Wastewater Management Program

Immersed Membrane Bioreactor Conceptual Site Layout

Headworks

The existing headworks would be incorporated into the MBR design as detailed previously in **Section 6.3.1.1**.

Influent Pump Station

In order to minimize excavation required at the location selected for the MBR basins, the influent pump station (incorporated in the existing headworks) would be required to lift the wastewater to the high water level in the pretreatment facilities. Once pumped to this elevation, the remainder of the flow through the biological processes would be by gravity. The influent pump station has a high level overflow that diverts wastewater to an equalization basin (Pond 1B) in the event the pump station fails or cannot match the influent flow. The pump station is designed to handle the design peak hour flow. Space has been provided for addition of future pumps for expansion to the future buildout peak hour flow.

Pretreatment

The pretreatment facilities consist of screening, grit removal and flow distribution. All wastewater flows into a common rectangular channel at the beginning of the pretreatment facility. A flow-splitting structure allows the flow to be split. Flow is split between two rotary drum screens. Provisions are made for the addition of a third screen in the future.

The rotary drum screen is a horizontal fine screen. This type of screen utilizes a perforated cylinder as the screen. MBR manufacturers recommend using perforations between 1 to 3 mm in diameter. The cylinder is mounted horizontally and is equipped with an inlet distribution weir. Screenings are captured inside the screen and are directed out the end of the cylinder. The advantage of using this type of screen is that the screening capture rate is very high. This is important for MBR systems since screenings can accumulate within the membrane fibers and cause physical damage to the membranes. Another advantage is that the screen is enclosed for odor control.

The grit removal facilities are located after the screens. Grit removal is necessary for MBR systems to prevent excess wear on the membranes for grit. A vortex type grit chamber would be designed to separate the grit from the screened wastewater. The grit would be pumped to a grit classifier to remove organics from the inert grit and to dewater the grit. The grit classifier and grit bin would be housed in a building to contain odors and minimize vector attraction.

All pretreatment channels, screening and grit facilities are enclosed to contain foul odors. A blower and a biofilter scrub foul air for odor removal. The blower continuously pulls air from the headspace in the enclosed facility. This maintains a negative pressure in the structure so that air cannot escape from the facility. The blower discharges into an odor control biofilter. The biofilter can be a compost design or a packaged synthetic media design.

Immersed Membrane Bioreactor (MBR)

The MBR system combines a suspended growth biological reactor with membrane filtration (microfiltration or ultrafiltration). Each MBR process train will consist of an anoxic zone for denitrification, an aeration zone for soluble BOD reduction and nitrification, and a membrane filtration zone for solids removal. Four MBR trains would be provided, each sized for an ADF of 1.25 MGD. The MBR will typically produce an effluent with BOD and TSS levels of less than 1 mg/L, and a turbidity of less than 0.1 NTU. The components of the MBR are described below.

Anoxic Zone: The first stage of an MBR is the anoxic zone. Main basin domestic wastewater flows from the pretreatment facility to a covered distribution channel running along the four anoxic zones. Wastewater is distributed into the four anoxic tanks through weir gates in the channel. The anoxic zone in each process train would be approximately 43 ft by 30 ft with a liquid depth of approximately 22 ft. The

HRT would be approximately four hours at ADF. The anoxic zones are equipped with mechanical mixers. From the anoxic zones, the wastewater flows to the aeration tanks.

Aeration Zone: Each aeration tank would be approximately 110 ft by 30 ft with a liquid depth of approximately 21 ft. The HRT would be approximately 10 hours at ADF. The aeration tanks are equipped with fine bubble diffusers for mixing and oxygen transfer.

Membranes: The membranes are located in a separate membrane basin. Four membrane tanks are proposed for the 5.0 mgd plant. Membrane cassettes are immersed in each basin; each cassette contains numerous membrane elements. A membrane element consists of a bundle of hollow microfiltration or ultrafiltration fibers or sheets, with a typical nominal pore size of approximately 0.1 to 0.4 microns.

A vacuum is applied to the module headers to draw the wastewater from the process tank through the membrane. Wastewater flows through the hollow fibers to a permeate pump. The permeate pump transfers the wastewater to the disinfection facilities or to the seasonal storage reservoir.

Mixed liquor from the membrane zone is continuously recycled back to the anoxic zone by a recycle pump in each membrane tank. This oxidized and nitrified recycle stream is blended with raw sewage (carbon source) to allow denitrification to occur in the anoxic zone. Periodically, a waste sludge pump located in each membrane zone pumps mixed liquor to the SSBs.

Air is typically fed to the underside of the membranes to prevent solids from binding on the surface of the membranes. One backwash storage tank would be provided for periodic backwash of the membranes, with a storage capacity of approximately 6,000 gallons. The backwash tank is filled with permeate from the MBRs. Sodium hypochlorite is periodically added to the backwash for control of bio-growth on the membrane strands. It is expected that the chlorine demand in the mixed liquor will consume any chlorine introduced by the backwash cycle.

UV Disinfection

A UV channel would be provided for wastewater effluent management through surface water discharge. The UV disinfection process would be as described in **Section 6.3.1.1** for Alternative 1.

Chlorine Disinfection

A chlorine contact basin would be provided to disinfect tertiary-treated wastewater for Title 22 recycled water discharge. The chlorine contact tank would be designed to meet Title 22 disinfected tertiary recycled water requirements. The disinfection system design would be as described in **Section 6.3.1.1** for Alternative 1.

Recycled Water Pump Station

A recycled water pump station would be required for recycled water distribution. The size and type of pumps required would be determined based on the hydraulic flow and storage characteristics and requirements of the recycled water distribution system.

Chemical Storage and Handling Facilities

The chlorine disinfection system would require sodium hypochlorite, which would be stored in an 8,000-gallon polyethylene tank. Duty and standby metering pumps would be provided for supply of sodium hypochlorite to the chlorine contact tank. It is expected that the metering pumps would be located indoors within an area for designed for spill containment. The chemical storage would be located outdoors in another spill containment structure. A canopy would be provided to shade the storage tank.

Sludge Stabilization Basin

Existing Primary Pond 1A would be converted into an SSB. WAS would be collected from the MBRs for further stabilization. The storage basins would have enough capacity to provide long-term storage. Based on the size of existing Pond 1A, it is expected that sludge storage capacity would exceed 10 years.

Solids Dewatering

As an option waste sludge from the clarifiers could be mechanically dewatered. The dewatered sludge would be taken to a landfill for disposal. Note that this sludge would not meet Class B requirements and could not be eligible for beneficial reuse without further treatment. At a minimum a facility including a sludge storage tank, sludge feed pump, polymer feed system and a two-meter belt filter press would be required for the initial construction. Provisions for adding a second belt press would be made. The belt press and ancillary equipment would be housed in building to protect the equipment from weather and to contain any odors. Dewatered sludge from the belt filter press would be conveyed via a screw conveyor to a waste container or truck trailer.

Flow Equalization and Storage

Ponds 1B, 3A, and 3B would be converted for storage of treated effluent. Accumulated solids in the ponds would be removed and inlet/outlet structures would be added.

6.3.3.2. Non-economic Advantages/Disadvantages

The non-economic advantages and disadvantages of the MBR system are summarized in **Table 6-7**.

Table 6-7: Non-economic Advantages and Disadvantages of the MBR

Advantages	Disadvantages
Small footprint.	Requires fine screening.
Extremely high quality effluent; state-of-the-art treatment.	Limited equipment manufacturers.
Achieves nitrogen removal.	Relatively “new” process.
Combines clarification and filtration with oxidation process.	Requires dedicated sludge handling facilities.
High MLSS provides resistance to loading shocks.	
Certified for CCR Title 22 use by CA DHS.	
Significantly reduces disinfection requirements.	
Provides pretreatment for TDS removal by reverse osmosis.	

6.3.4. Process Alternative 4 - Sequencing Batch Reactor

Sequencing Batch Reactors (SBRs) are a variation of the activated sludge process capable of producing high quality effluent. The principal difference between SBRs and oxidation ditches are that stabilization and solids separation are sequentially accomplished in a single reactor operating in batch mode as opposed to an individual aeration basin and clarifier, which are designed for continuous flow.

After the wastewater flows through the headworks and is screened, it is routed to the SBR tank. The SBR tank is a single concrete reactor where five different steps are carried out. The first step is the fill mode, where wastewater is introduced at 25%-100% of the design volume. When the set-point volume is reached, flow to the tank is stopped and diverted to a parallel SBR tank to allow the WWTP to continuously receive and treat the wastewater. Alternate phases aeration and mixing (without aeration) follows as the second step. The aeration phase promote soluble BOD removal and nitrification. The mixing or anoxic phase promotes denitrification. Once completed, the process switches to settling mode, the third step, which provides solids separation. When the solids have settled, the clarified portion is decanted (step four) and disinfected prior to discharge, while the solids are wasted (step five).

The clarified effluent continues down the process train undergoing additional treatment depending on the discharge capacity and/or discharge point. For direct discharge to the percolation beds, no disinfection is required of the clarified effluent prior to discharge. If the discharge point is surface-discharge to the river, then the clarified effluent must first be filtered to meet possible turbidity controls on the river and then disinfected with UV light. UV disinfection is preferred for river discharge since it avoids chemical addition, such as with chlorination, which increases the risk for DBP formation. For discharge of recycled water, tertiary filtration would be required as an added process prior to disinfection by sodium hypochlorite.

WAS and solids residuals would be disposed of in one of the existing facultative treatment ponds, which would be converted to an SSB. At the SSB, the solids residuals would be concentrated, compacted, and further stabilized. SSBs are designed with sufficient capacity to provide long-term stabilization of the sludge, with some facilities operating up to 10 years without requiring removal of accumulated sludge. Alternatively, the solids could be dewatered and hauled to a sludge disposal site.

6.3.4.1. Facility Design

Facility design of this WWTP alternative was completed on a preliminary level. A process flow diagram illustrating the proposed treatment train is shown in **Figure 6-7**. Unit process summaries for major processes are included in a conceptual site layout is included in **Figure 6-8** showing major facility sizes and locations for treating 5.0 MGD ADF. Future additional facilities are also shown to illustrate expandability to the proposed new buildout flow of 7.5 MGD ADF. Unit process summaries for major processes are included in **Table 6-8**.

Table 6-8: Unit Process Summary for the Sequencing Batch Reactor

Unit Process [a]	Design Criteria [b]	Size (ft) [c]	ADF 5.0 MGD	ADF 7.5 MGD
Flow meter	Range 0-28 mgd, 0.25 fps min., 33 fps max.	16 inch ∅	1	1
Fine screen	Inclined rotary in-channel type 0.25-inch slot width	6 ∅	1	2
Grit removal	Vortex type	12 ∅	1	1
SBR Basins	6 cycles/day 1.45 days HDT 16.3 days SRT	100L x 100W x 19.5D	5	7
Tertiary Filtration	Average turbidity < 2 NTU 2.5 gpm/ft^2 at ADF with 1 cell out of service, 5.0 gpm/ft^2 at PHF	16.7L x 16.7W	6	8
UV disinfection	Total coliform MPN 2.2 per 100 mL sample (surface discharge)	TBD	1 channel	2 channels
Chlorination	Contact time = 120 minutes @ 5.5 mgd	470L x 12W x 8D	1	2
Sludge stabilization basin	15 lb VSS/10^3 ft^2/d	38 MG	1	1

[a] Design is based on ADF.
[b] Minimum design freeboard is 2 ft.
[c] Length, width, depth, height, and diameter are denoted as L, W, D, H, and ∅ respectively.

Headworks

The design of the headworks would utilize the same approach detailed previously in **Section 6.3.1.1**.

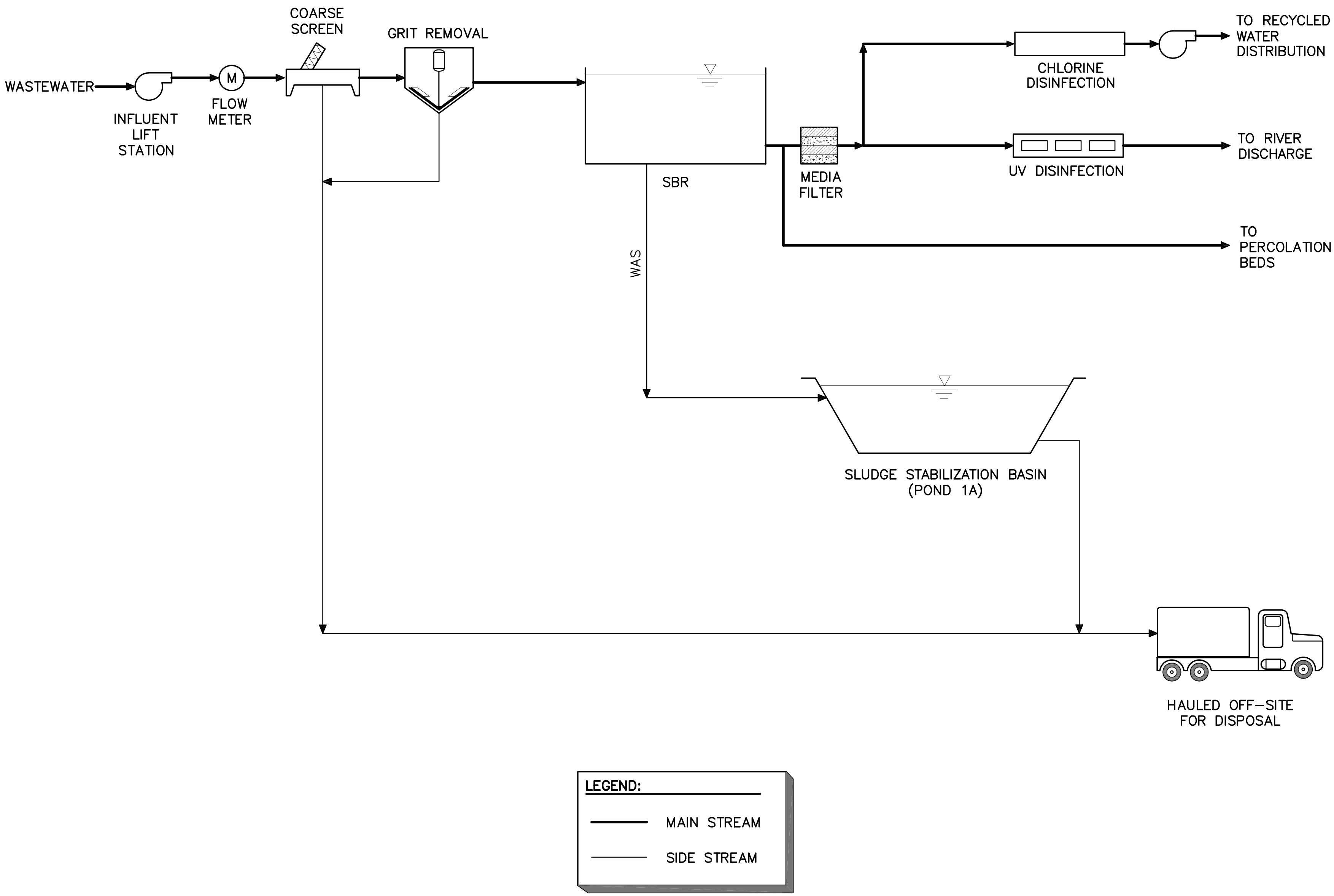

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Figure 6-7
City of Hollister Long-Term Wastewater Management Program
SBR Process Flow Diagram

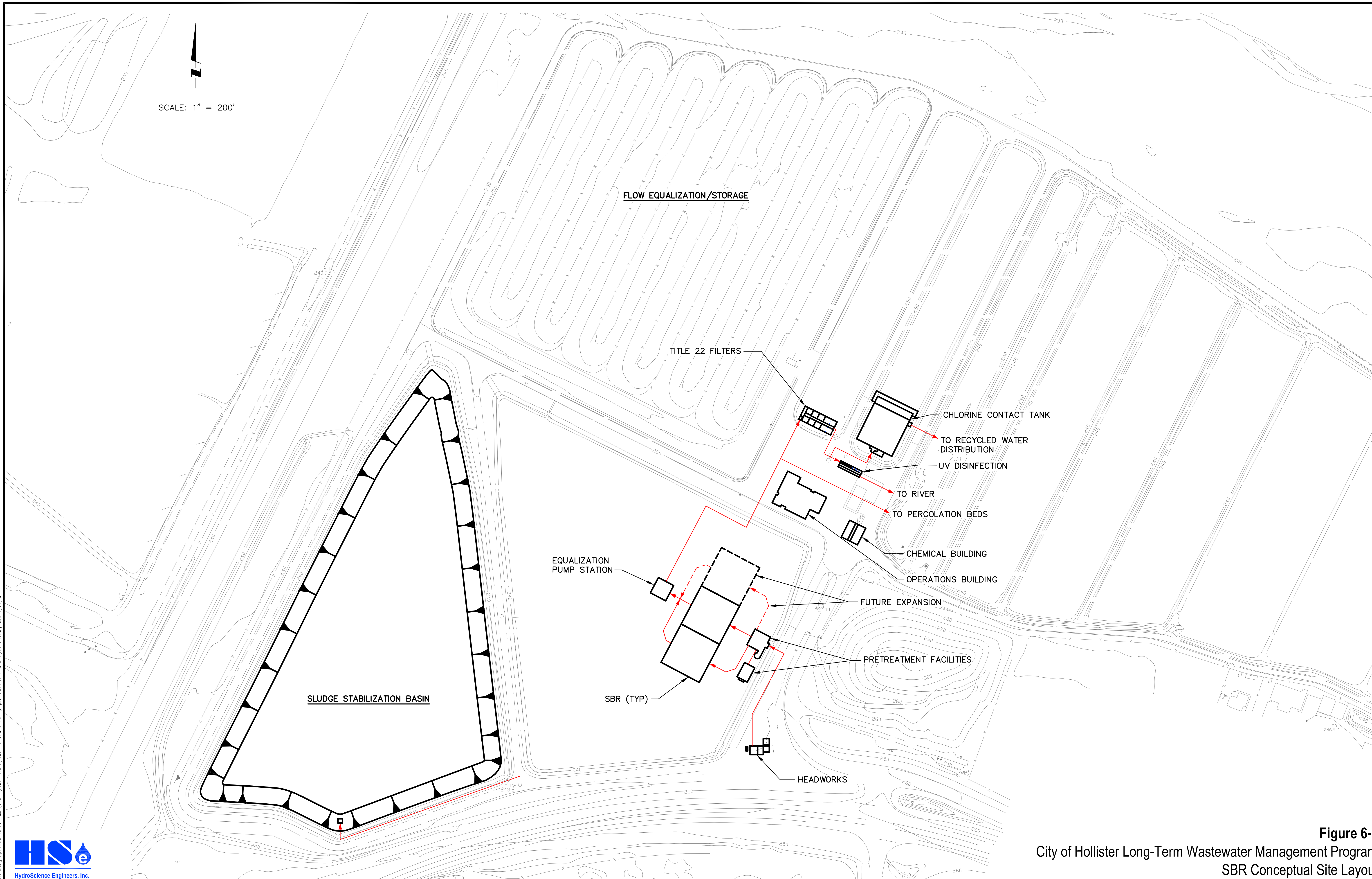

Figure 6-8
City of Hollister Long-Term Wastewater Management Program
SBR Conceptual Site Layout

Influent Pump Station

In order to minimize excavation required at the location selected for the SBR basins, the influent pump station (incorporated in the existing headworks) would be required to lift the wastewater to the high water level in the pretreatment facilities. Once pumped to this elevation, the remainder of the flow through the biological processes would be by gravity. The influent pump station has a high level overflow that diverts wastewater to an equalization basin (Pond 1B) in the event the pump station fails or cannot match the influent flow. The pump station is designed to handle the design peak hour flow. Space has been provided for addition of future pumps for expansion to the future buildout peak hour flow.

Pretreatment

The pretreatment facilities consist of screening, grit removal and flow distribution. All wastewater flows into a common rectangular channel at the beginning of the pretreatment facility. A flow-splitting structure allows the flow to be split to two identical channels. One channel houses a self-cleaning fine screen. The second channel is a bypass channel and contains a manual bar screen. Under normal operation, all wastewater flows through the self-cleaning coarse screen. However, a weir allows wastewater to either overflow or be diverted to the bypass channel, in the event the self-cleaning screen fails or is down for maintenance.

The self-cleaning screen is an inclined in-channel rotary screen. This type of screen utilizes a slotted or perforated cylinder as the screen. The cylinder is mounted in the rectangular channel at a 45-degree angle and a helical screw/scraper conveys solids up the cylinder into a dewatering section and then into a holding bin. The advantage of using this type of screen is that the screening, washing and compacting of the screened material is accomplished in one unit. Another advantage is that the top portion of the screen (above the channel) can be enclosed for odor control, as well as the solids discharge shaft to the screenings bin.

Following screening, the channel allows future addition of grit removal. Grit removal would not necessarily be required for the SBR alternative. If selected, a vortex type grit chamber would be designed to separate the grit from the screened wastewater. The grit would be pumped to a grit classifier to remove organics from the inert grit and to dewater the grit. The grit classifier and grit bin would be housed in a building to contain odors and minimize vector attraction.

All pretreatment channels, screening and grit facilities are enclosed to contain foul odors. A blower and a biofilter scrub foul air for odor removal. The blower continuously pulls air from the headspace in the enclosed facility. This maintains a negative pressure in the structure so that air cannot escape from the facility. The blower discharges into an odor control biofilter. The biofilter can be a compost design or a packaged synthetic media design.

Sequencing Batch Reactor

The secondary treatment equipment would be installed on the site of the high rate treatment ponds, Pond 2. That area is at a higher elevation than the influent pump station, therefore the wastewater flow would be pumped to the headworks. The site for the SBR would be graded so that it is situated at a lower elevation than the headworks, so that the wastewater would flow by gravity to the SBR.

The SBR system would consist of square concrete basins with a series of aeration headers and diffuser assemblies. Five separate SBR basins would be provided for flexibility for O&M of the system over a wide range of flows. Each basin would be approximately 100 ft wide by 100 ft long by 19.5 ft deep and have a volume of approximately 1.5 MG. Space would be designated for additional SBR basins in the future to meet buildout flows.

From the SBR basins, the process streams would be combined and flow to a wet well to pump water to UV disinfection for percolation or filters for reclamation or river discharge. While, excess sludge would be wasted to the SSBs for additional stabilization.

Title 22 Media Filtration

The design of the media filters would utilize the same approach detailed previously in **Section 6.3.1.1**. However, it is expected that media filtration would be sized for both surface water discharge and recycled water production.

UV Disinfection

For surface water discharge, it is assumed that the disinfection standard will be a total coliform MPN of 2.2 per 100 mL. The type and design of the UV disinfection system would be as described previously in **Section 6.3.1.1**.

Chemical Storage and Handling Facilities

The chlorine disinfection system will require sodium hypochlorite, which would be stored in an 8,000-gallon polyethylene tank. Duty and standby metering pumps would be provided for supply of sodium hypochlorite to the chlorine contact tank. It is expected that the metering pumps and the storage tank would be located outdoors within a bermed area for spill containment. A canopy would be provided to shade the pumps and storage tank.

Sludge Stabilization Basin

Existing Primary Pond 1A would be converted into an SSB. WAS would be collected from the MBRs for further stabilization. The storage basins would have enough capacity to provide long-term storage. Based on the size of existing Pond 1A, it is expected that sludge storage capacity would exceed 10 years.

Solids Dewatering

As an option waste sludge from the clarifiers could be mechanically dewatered. The dewatered sludge would be taken to a landfill for disposal. Note that this sludge would not meet Class B requirements and could not be eligible for beneficial reuse without further treatment. At a minimum a facility including a sludge storage tank, sludge feed pump, polymer feed system and a two-meter belt filter press would be required for the initial construction. Provisions for adding a second belt press would be made. The belt press and ancillary equipment would be housed in building to protect the equipment from weather and to contain any odors. Dewatered sludge from the belt filter press would be conveyed via a screw conveyor to a waste container or truck trailer.

Flow Equalization and Storage

Ponds 1B, 3A, and 3B would be converted for storage of treated effluent. Accumulated solids in the digesters would be removed and inlet/outlet structures would be added.

6.3.4.2. Non-economic Advantages/Disadvantages

The non-economic advantages and disadvantages of the sequencing batch reactor system are summarized in **Table 6-9**.

Table 6-9: Non-economic Advantages and Disadvantages of the Sequencing Batch Reactor

Advantages	Disadvantages
Equalization, biological treatment, clarification can be achieved in a single reactor.	High level of sophistication is required for timing units and control compared to other alternatives.
Operating flexibility and control.	Higher level of maintenance associated with greater sophisticated controls, automated switches, and automated valves.

Advantages	Disadvantages
Minimal footprint.	Tendency to develop algae growth due to the longer retention time in each basin.
Potential cost savings by eliminating clarifiers and other equipment.	Susceptible to public nuisance problems when basins are not fully loaded.
Capable of producing secondary-treated wastewater.	Potential of discharging floating or settling sludge during the draw or decant phase.
	Potential plugging of aeration devices during selected operating cycles.
	Potential requirement for equalization after the SBR due to batch operation.
	Batch solids wasting requires immediate attention to solids handling and disposal.
	Increased power costs due to increased mixing requirements.
	Unable to achieve nitrogen removal without adding treatment processes.

6.4. Wastewater Alternatives Estimated Costs

Capital and annual cost estimates were prepared for the LTWMP to provide comparative order of magnitude costs for upgrading the existing DWTP into the treatment alternatives considered at a capacity of 5.0 MGD ADF. This estimate, summarized in **Table 6-10**, was prepared in accordance with the guidelines of the American Association of Cost Engineers (AACE). According to the definitions of AACE, the order of magnitude estimate is defined as an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within +50% or -30%. These percentages should be viewed as statistical confidence limits, and should not be confused with contingencies.

The cost estimates shown, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. As a result, the final project costs will vary from estimates presented here. Because of these factors, project feasibility, benefit/cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure project evaluation and adequate funding.

Table 6-10: Order of Magnitude Cost Estimate on DWTP Upgrade Alternatives (5.0 MGD)

Description	Extended Aeration	Oxidation Ditch	Membrane Bioreactor	Sequencing Batch Reactor
		2005 Costs in x1,000 of dollars		
Paving and grading	$2,722	$2,722	$2,722	$2,722
Demolition	$325	$325	$325	$325
Yard Piping	$3,070	$3,070	$3,070	$3,070
Pretreatment Facilities	$905	$905	$905	$905
Septic Receiving Station	$241	$241	$241	$241
Extended Aeration Equipment	$4,720	--	--	--
Oxidation Ditch Equipment	--	$8,368	--	--
MBR Equipment	--	--	$14,422	--
SBR Equipment	--	--	--	$6,390
Secondary Clarifier	$2,760	$2,760	--	$2,760

Description	Extended Aeration	Oxidation Ditch	Membrane Bioreactor	Sequencing Batch Reactor
Title 22 Filtration	$4,895	$4,895	--	$4,895
Chlorine Contact Basin	$1,621	$1,621	$1,621	$1,621
UV Disinfection	$1,845	$1,845	$1,845	$1,845
Solids Handling Facilities	$810	$810	$810	$810
Effluent Pump Station	$52	$52	$52	$52
Odor Control Biofilter	$172	$172	$172	$172
Solids Stabilization Basin	$158	$158	$158	$158
Vactor Truck Dump Facility	$32	$32	$32	$32
Chemical Handling Facilities	$299	$299	$299	$299
Plant Water Pump Station	$129	$129	$129	$129
Plant Drain Pump Station	$84	$84	$84	$84
Operations Building	$1,415	$1,415	$1,415	$1,415
Electrical/Instrumentation	$8,150	$7,899	$8,395	$8,250
General Conditions	$2,355	$2,355	$2,355	$2,355
Liquefaction Mitigation	$2,670	$2,670	$2,670	$2,670
Subtotal	$39,430	$42,827	$41,722	$41,200
Contingency 20%	$7,886	$8,565	$8,344	$8,240
Total Construction Costs	$47,316	$51,392	$50,066	$49,440

6.5. Recommended Treatment Design

Process Alternative 3, the Immersed Membrane Bioreactor (MBR), was recommended as the preferred long-term treatment upgrade for the DWTP. The MBR is a cost competitive alternative with a proven operational track record. All four process alternatives considered in this study are feasible designs able to produce high-quality effluent to meet the DWTP's LTWMP requirements and cost differentials are not significant. Where the advantages of the MBR alternative become distinguished over the other process alternatives is in the high quality effluent, reliability, compatibility with all effluent management alternatives and compactness of the process. The City of Hollister considered a number of factors in selecting the MBR alternative over the other alternatives. These factors included:

- Treatment process must produce Title 22 disinfected-tertiary recycled water
- Treatment process must meet strict nitrate limits anticipated
- Treatment process must be compatible with future dissolved solids removal

While all the alternatives could be designed to accommodate the first two factors, only the MBR process is readily compatible for a dissolved solids removal process such as reverse osmosis (RO). The other alternatives would require the addition of expensive microfiltration equipment as a pretreatment for an RO treatment system. The MBR includes microfiltration within its treatment process.

A more detailed description of the selected MBR treatment plant is presented in **Section 9**. The process flow diagram for the recommended WWTP is shown in **Figure 6-5**. A conceptual plan of the DWTP is contained in **Figure 6-6**.